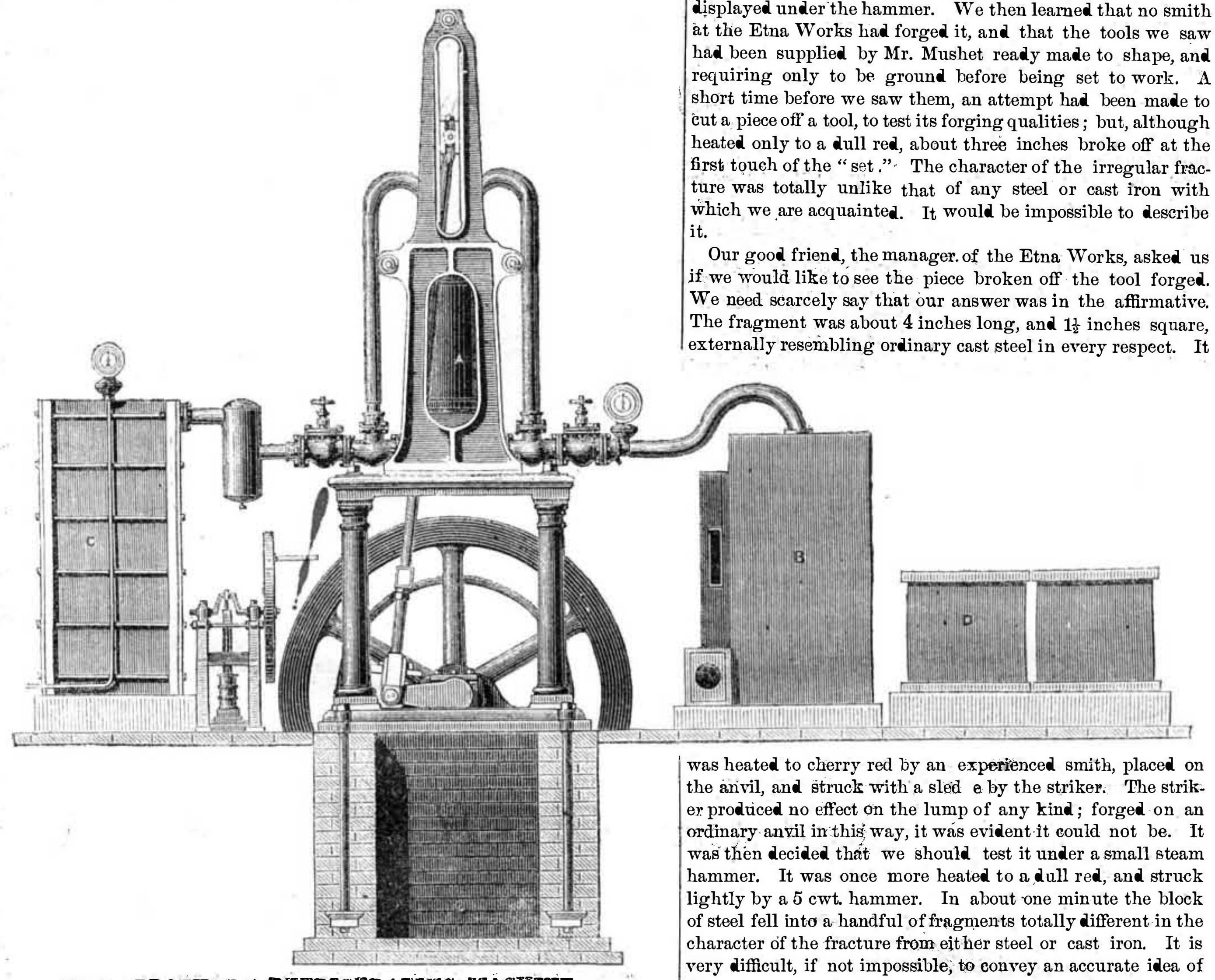
English Ice-Making Machine.

We copy from the London *Engineering* the illustration of a device for producing ice, or for cooling liquids, by the evaporation of a volatile liquid under low pressue or in a vacuum.

We copy from *Engineering*: Referring to the engraving, A, is the double-acting air pump; B, the refrigerator; C, the condenser; and D, the ice troughs. The refrigerator, B, may be described as a kind of vertical multitubular boiler, the tubes of which are, when the machine is employed for ice making, traversed by a stream of strong brine, this brine being replaced, when the machine is used for cooling only, by the water which is to be cooled. The tubes are of thin copper, and are of small diameter, whilst by an arrangement of diaphragms the water or brine is made to traverse the length of the refrigerator several times. The liquid ether from the condenser is admitted to the lower end of the refrigerator, and, in consequence of the vacuum formed by the air pump, it there evaporates, absorbing heat from the brine or water. The vapor arising from the evaporation of the ether is drawn off by the air pump from the top of the refrigerator and transferred to the condenser, which consists merely of a coil of pipe inclosed in a wooden tank containing water. In the condenser the ether vapor, which has become heated by its compression, parts with its heat and becomes liquefied, the liquid ether thus obtained being, as we have said, transferred through a pipe back again to the refrigerator for re-evaporation.

The machine is used sometimes for ice making and sometimes for cooling the water used in ordinary refrigerators on the establishment, and it is for the latter purpose that it can be used most economically, as we shall show presently. The air pump of the machine is 20 in. in diameter with a stroke of 37 in., and it is driven by a 15-horse non-condensing horizontal engine at a speed of 40 double strokes per minute. The general arrangement of the air pump is, as will be seen by our engraving, similar to that of a table engine, the cylinder being placed in a vertical position on an entablature, beneath which the crank shaft, by which the machine is driven, is situated. The smallest practicable amount of clearance is allowed between the piston of the pump at the ends of the stroke and the cylinder covers, and every care is taken to arrange the valves so that the capacity of the waste space which the pump is unable to clear of vapor at each stroke is reduced to the smallest possible amount. So well has this been done, that the pump is capable of producing a vacuum of 29 in. of mercury; but the vacuum which ordinarily exists in the refrigerator, when the machine is in regular use for ice making, averages 26 in. of mercury, and that when the machine is cooling water only about 20 in. The difference between the two pressures last mentioned is due to the fact that, when the machine is employed for ice making, the ether vapor in the refrigerator falls to a much lower temperature than when the apparatus is used for cooling water only, and this being the case its tension is also less. Thus, when ice making is going on, the brine passing through the refrigerator is cooled down to from 10° to 18° Fahr., and is, in fact, returned to the refrigerator to be cooled when at a temperature of 32°; whilst, when water only is being cooled, the temperature does not fall below about 39° or 40° Fahr.

The pressure in the condenser varies from 2 lb. to 3 lb. per square inch, according to the supply and temperature of the water used for condensing purposes. With an abundant supply of water, the pressure in the condenser would, when the machine was ice making, be practically nothing; but the existence of a slight pressure in no way interferes with the working of the machine, but merely throws a little extra work on the pump. It may be noticed here, as a distinctive feature of Messrs. Siebe's machine as compared with the refrigerating machines acting by the expansion of compressed air, or by alternate production and liquefaction of ammoniacal gas, that no parts of the apparatus are subjected to severe pressure. The 2 lb. or 3 lb. pressure per square inch in the condenser may be considered to be practically nothing, whilst the refrigerator is subjected to a collapsing pressure only, and that, of course, cannot exceed, however nearly it may approach, the pressure of the atmosphere. With such low pressures as these, there is, of course, no difficulty, by the aid of good workmanship, in making all joints perfectly tight, and thus guarding against loss of ether. As the heat generated by the compression of the ether vapor is considerable, the stuffing box through which the piston rod passes is kept cool by jets of water, and similar means are employed to cool the delivery valves.



SEIBE BROTHERS' REFRIGERATING MACHINE.

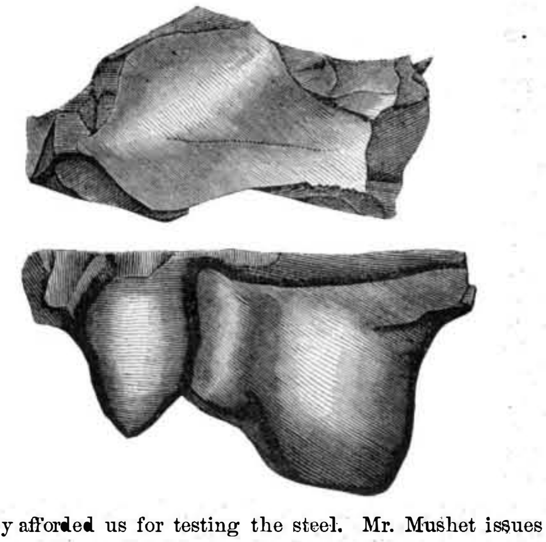
* * *

SOMETHING NEW IN STEEL.

It has long been a disputed point where steel leaves off and wrought iron begins; but it is generally received that the difference between steel and cast iron is so great that no doubt can exist as to which is which. Within the week we have proved to our own satisfaction that it is just as difficult to distinguish between cast iron and steel, as it is to define those characteristics in which steel differs from wrought iron. There is, indeed, at this moment, a so-called steel in the market, which possesses such extraordinary attributes, that the metallurgist may well feel in doubt under what head it should be classed. To all intents and purposes it is a new material, and as such it claims the attention of our readers.

For some time past Mr. Mushet has ad-vertised a "special tool steel" warranted to last—we are afraid to say how much longer than any other steel, worked in the same way and in the same shape. Our readers may have seen these advertisements, and passed them over as legitimate trade puffs. In this they were wrong. The material—be it steel, cast iron, or some alloy—is, in reality, one of the most singular substances we have ever met with, and it possesses qualities which deserve the attention, not only of engineers, but of analytical metallurgists. We propose to put our readers in possession of all that we know about it, leaving them to draw their own conclusions, and trusting that Mr. Mushet will supply more information to the scientific public than he has hitherto thought proper to furnish to purchasers.

A few days since we visited what we shall term the Etna Works. Chatting with the manager about things in general and engineering in particular, the subject of tool steel turned up, and we then learned that a couple of tire turning tools, made of Mr. Mushet's tool steel, were in use at the moment, which we were assured possessed such qualilies, that managers, foreman, smiths, and turners were alike at a loss to comprehend the nature of the material with which they had to do. Our curiosity was excited, and every facility was courteously afforded us for testing the steel. Mr. Mushet issues with each bar printed instructions as to the system to be adopted in working it. In the first place we are told that, after forging or otherwise working the tool steel, it is to be suffered to cool slowly, and under no circumstances to be quenched and tempered. Now, it is well known that the hardest ordinary cast steel may be softened so much by heating it to a bright red and suffering it to cool slowly, that it will not retain a sharp edge for two minutes. In other words, its temper may be drawn. We proved, on the other hand, that the temper of Mr. Mushet's "special tool steel" cannot be drawn. After being heated red hot and suffered to cool slowly, it still remained harder than any ordinary cast steel tempered at straw color. The proof of this lies in the fact that a tool of the best ordinary cast steel required to be ground three times in planing a given area of hard cast iron, whereas a tool of Mr. Mushet's steel not only planed a similar area without regrinding, but remained to all intents and purposes nearly as sharp as when it began. It is rather more brittle than ordinary steel, in so far that a different angle, slightly more obtuse than that commonly employed, must be given to turning tools, but it certainly is not objectionably brittle. In the shape of chisels, we have no experience of its qualities whatever.



Having satisfied ourselves of its good qualities in the shape of a tool, we next proceeded to investigate its properties as displayed under the hammer. We then learned that no smith at the Etna Works had forged it, and that the tools we saw had been supplied by Mr. Mushet ready made to shape, and requiring only to be ground before being set to work. A short time before we saw them, an attempt had been made to cut a piece off a tool, to test its forging qualities; but, although heated only to a dull red, about three inches broke off at the first touch of the "set." The character of the irregular fracture was totally unlike that of any steel or cast iron with which we are acquainted. It would be impossible to describe it.

Our good friend, the manager of the Etna Works, asked us if we would like to see the piece broken off the tool forged. We need scarcely say that our answer was in the affirmative. The fragment was about 4 inches long, and 1½ inches square, externally resembling ordinary cast steel in every respect. It was heated to cherry red by an experienced smith, placed on the anvil, and struck with a sledge by the striker. The striker produced no effect on the lump of any kind; forged on an ordinary anvil in this way, it was evident it could not be. It was then decided that we should test it under a small steam hammer. It was once more heated to a dull red, and struck lightly by a 5 cwt. hammer. In about one minute the block of steel fell into a handful of fragments totally different in the character of the fracture from either steel or cast iron. It is very difficult, if not impossible, to convey an accurate idea of the appearance of the fragments. The foregoing engraving of two fragments, natural size, will suffice, at least, to show that they in no way resemble fragments of ordinary cast steel broken up in the same way. The real pieces lie before us, and resemble nothing in the world so much as bits of vitreous slag from a blast furnace. They are not like any metal in the slightest degree, but on filing them the surface assumes the character of polished steel. All the pieces manifested the same conchoidal fracture. In a second experiment with another piece a far higher temperature was imparted to the metal, and it was then drawn with little difficulty to about a quarter of an inch square. It was hardened in the usual way, and did not fly, so that it is possible that in small masses it will bear hardening. The little piece is so intensely hard that no file will touch it. A lump of the same steel an inch and a quarter square cracked in all directions when heated and quenched.

What is this material? Is it steel or cast iron? Under the hammer it behaves more like cast iron than anything else; as a tool it behaves as neither cast iron or steel ever behaved before. To all intents and purposes it is a new metal. Mr. Mushet has not patented its mode of production, which he reserves as a secret. That it contains an enormous quantity of carbon is, in a sense, proved by its hardness. Why does not this carbon render it as brittle as cast iron? Is the carbon combined or graphitic? Is the "steel" simply an alloy of iron with some other metal? What is the proper method of forging it in ordinary smith's fires? These and some other questions present themselves for solution. The only conclusion we can arrive at, and we confess we do not believe it to be the correct solution of an interesting problem, is that Mr. Mushet first forges his tools or bars from a hard cast steel of the ordinary kind, and then, by some process such as recementation, imparts an additional hardness to them, which, although it makes the tool as such invaluable, renders the bar from which tools should be made, as such, useless in the hands of all but first rate smiths.—*The Engineer.*

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Dyeing and Coloring.—We invite attention to the article on another page written for the Scientific American, by the well known Dr. M. Reimann, of Berlin, author of a valuable work on "Aniline and Aniline Colors." We hope during the year to publish several articles from his pen.

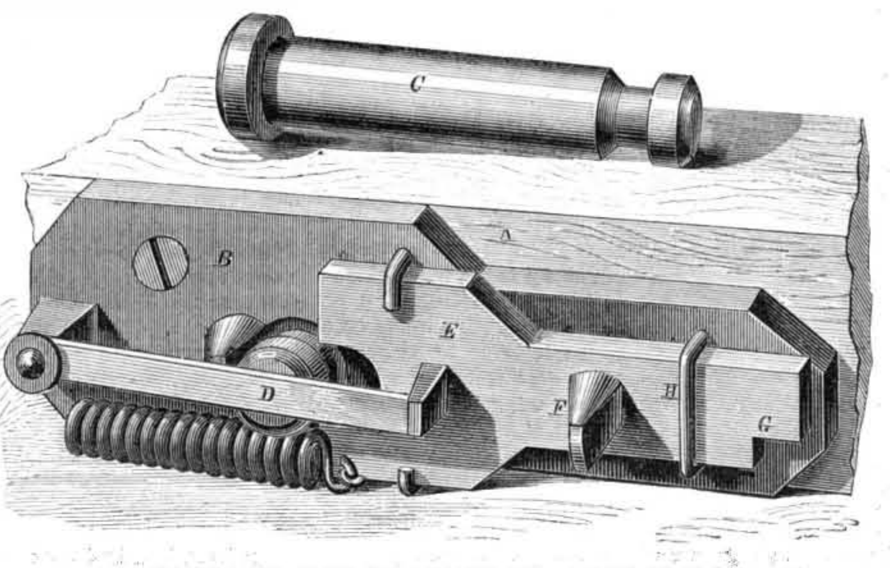
* * *

It is said that the largest distillery in the United States has just been finished near Lexington, Ky. It will be able to make 2,400 gallons of whisky per day. Thirty other distilleries in the same district will begin operations January 1st, and their aggregate daily product is estimated at 25,000 gallons.

Improved Bolt for Securing Window Shutters.

The ordinary method of locking the shutters of buildings is to pass the bolt through from the outside and then secure it on the inside by means of a strap or split key passed through a hole in the bolt near the end. Beside the annoyance of being compelled to pass into the building to lock the bolt, it is an unsafe contrivance, as sometimes by turning the bolt from the outside the key will drop out, and in any case the key is too slender to resist any considerable strain upon it from the outside before breaking. The device, however, shown in the accompanying illustration has none of these objections, and is in all respects a most admirable contrivance for the purpose intended.

A represents the wall or casement of a building, on the inside of which the lock is secured. It consists of a plate, B, through which the bolt passes. The bolt is shown detached at C, and the end is seen directly under the flat spring at D. As will be seen the bolt has an annular score near the end, into which the end of the slide, E, fits when the shutter is locked. When the bolt is to be released the slide, E, is moved back from the bolt by the thumb piece or knob, F, when the flat spring, D, throws the bolt partially out of the plate, and its end engages with the snug on the slide, E, and retains it in the position seen in the engraving. When the shutters are closed and ready to be locked, the bolt is passed through from from the outside in the ordinary manner, its end pressing against the flat spring, releasing the slide, when the spiral spring instantly brings the slide to engage with the bolt, and securely locks the slide by springing the notch, G, on the end of the slide on the staple, H. This is effected by the position of the spiral spring, which, being on one side the slide, tends to draw that side more than the other. The fastening may be used in any position, either vertical, horizontal, or at any angle, working with equal certainty and effect. It may be applied to any shutter, and the ordinary bolts may be altered to suit, simply by welding on them an end containing the annular nick. Except the springs, the fastening is made of malleable cast iron, and the inventor desires to correspond with manufacturers of malleable iron castings with a view to the sale of the patent or the production of the device.



FARRAR'S PATENT SHUTTER FASTENER.

Patented through the Scientific American Patent Agency, December 8, 1868, by W. B. Farrar, who may be addressed at Greensborough, N. C.

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Vienna White Bread.

Prof. Horsford gives the following recipe for making the celebrated Vienna white bread: In the first place, great care is taken in the preparation of the flour. Scrupulous neatness and cleanliness are observed in all the processes of preparing the yeast and dough. The dough is placed in an oven somewhat of the type of the aerotherme, that is surrounded by currents of heated air, maintaining a uniform temperature of about 380°. By an arrangement of steam pipes, jets of steam are introduced into the oven to maintain an atmosphere saturated with moisture, and so retard the evaporation of water from the loaf during all the early part of the baking. When the loaf has attained its fullest distension and is penetrated by myriads of minute pores, the steam is shut off, and a side door, communicating with a separate fire from that which heats the oven, is opened. From this the heat of an intense blaze is flashed into the oven to be reflected from the low, glazed, tile roof, and give that requisite delicate red tint to the surface, which at the same time charges a thin crust with an aroma which is the product of roasting—an essential oil—most grateful to the palate. This part of the operation is brief, and is watched through a glass door. When complete the loaves are taken from the tins and immediately varnished with warm milk or water, with which a little good melted butter has been incorporated. The water of the milk quickly evaporates, and leaves a fine glazed surface.

We can testify from considerable personal experience that the Vienna bread and beer are the best to be found anywhere.

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The Growth and Prosperity of Michigan.

Many of our readers can remember when Michigan was in the far West, only to be reached by tedious journeyings through wide regions of unsettled country. But to-day Michigan has a population of more than a million; six incorporated colleges, one of them a University, with law, medical, literary, and scientific departments, and with more than twelve hundred students; an Asylum for the Blind and the Deaf; two Asylums for the Insane; a Normal School; high schools in every considerable town, and a system of public instruction as thorough, as wisely adjusted, and as efficient as in any State of the Union, so good indeed, that private schools are hardly known. Pupils come from all the States of the West, not only to the University, but to the Union Schools of Michigan. The finest and largest buildings, the most beautiful for situation, and most convenient in their appliances, are those which are set apart for public instruction. No interest is so jealously guarded as this. Every city and every county has its superintendent of schools. There is the same zeal for education in the newer as in the older settlements, in Saginaw and Muskegon, as in Monroe and Detroit. The market for school books in these forest cities is not less sure and regular than the market for boards and shingles.

Classic and foreign learning flourishes on what were but yesterday Indian hunting grounds; and the youths and maidens know more of Goethe and Virgil and Xenophon than of the legends of the red men. This strange mingling of ancient lore with the traditions of savage life is presented to us in the names of Michigan towns and cities. Pontiac borders upon Troy; just beyond Owasso is Ovid; Metamora joins Attica; Adrian is the next town to Tecumseh; Athens is but half an hour's ride from Wakeshma; and in Lenawee county we find Rome and Palmyra close to Madison and Franklin. Enough of the Indian appellations are retained to preserve a native flavor amid the classic and romantic names by which the famous sites of Europe and Asia, ancient and modern, from Caledonia to China, are represented in this favored Peninsula.

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HOW TO CONSTRUCT A TOY STEAM-ENGINE.

A communication from T. D. Quincy, Jr., a high school pupil, of Dorchester, Mass., gives directions for the construction of a toy steam engine, most of the parts of which may be made by any boy of ordinary intelligence, possessing a slight knowledge of the use of tools, at a very slight cost. It is a single acting, oscillating engine of which A, Fig. 1, is the boiler, which consists of a fruit can about 4 inches in diameter by $4\frac{3}{4}$ inches in hight, with a new end soldered on where it was opened. B, C, D, represents the gage cock, which is made by turning a piece of brass to the form indicated at C, and drilling a hole through it in the globular part, which is then reamed out tapering. The plug, D, of the cock is turned to fit the hole in C, and seated by grinding it in with grindstone grit and oil at first, and afterward with oil alone. A piece of wire will do for the handle. Cut a thread on D, and fit a nut on it to hold the plug D in C; then put the two together and drill a hole longitudinally through C and across D. The cock is then complete. It may be cheaper to purchase the cocks already made at any gas fixture or hardware establishment, but these directions are intended for those who cannot readily avail themselves of this accommodation. E is the safety valve with its parts. F shows the form of the seat of the valve which has a hole drilled through it, as seen by the dotted lines, and beveled at the top to receive the piece marked G. Place these together and seat them by grinding, as in the case of the gage cock. Make a score in the small portion of G to receive the edge of the safety valve lever. This lever is merely a light bar with a hole in each end, one end to be attached to a stud, or fulcrum secured to the top of the boiler by soldering, and the other to a light spring on the side of the boiler with an adjusting nut at the top, or it supports a hook on which weights may be suspended. These described, two of the most important points relating to the boiler may be understood—the gage for ascertaining the hight of the water; and the safety valve, the means of regulating the steam pressure.

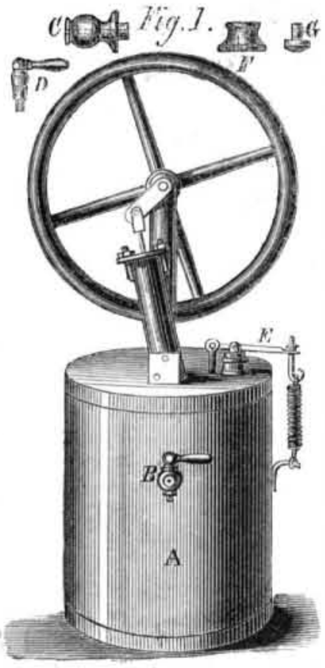


Fig. 1.

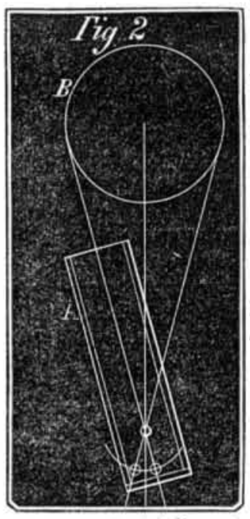


Fig. 2

The cylinder of the engine is a piece of brass tubing, $2\frac{1}{4}$ inches long and $\frac{1}{2}$-inch internal diameter, ground out true. The piston is a disk of brass, $\frac{1}{4}$ inch thick, with a wire soldered to its center as the piston rod. On opposite sides of the cylinder, near the top, are soldered two screwed pieces of wire designed to hold the cylinder end and stuffing box combined, in place.

Fig. 2 is a diagram of the cylinder, and its connections, A, is the cylinder, and B the path of the crank pin. Three holes are seen near the bottom of the cylinder, with an arc describing the oscillation of the cylinder, the upper hole being the center of the circle of which the arc is a segment. On the side of the bottom of the cylinder is soldered a piece of brass, about $\frac{1}{16}$ of an inch thick and $\frac{5}{8}$ by $\frac{9}{16}$ in area. The lower hole is drilled through a plate into a cylinder near its bottom; the upper hole $\frac{3}{8}$ of an inch above it and through the plate only, a small hole slightly indenting the cylinder being made exactly opposite without piercing the shell. Another piece of brass, $\frac{1}{8}$ inch thick, $\frac{5}{8}$ wide, and $\frac{3}{4}$ long, has a hole drilled through it $\frac{9}{16}$ of an inch from the bottom, and that receives a bit of wire soldered in and projecting $\frac{1}{16}$ of an inch. On a $\frac{3}{8}$-inch radius from this point, $\frac{3}{32}$ of an inch from the center line, drill two holes, that on the right hand entirely through the piece and that on the left about half way through, meeting one drilled from the bottom. The inner faces of this plate and that on the cylinder must be fitted smoothly together. These constitute the valve faces, or valve and seat of the engine.

The pillars or supports of the wheel, shaft, and crank, are rods of brass or iron, $3\frac{7}{8}$ inches high, with holes near the top for the shaft. At the hight of $\frac{9}{16}$ of an inch from the bottom a hole is drilled and tapped, through which a pointed screw is passed, the point of which enters the hole in the side of the cylinder opposite that on which the plate is soldered. The thicker and separate plate is soldered to the top of the boiler, the side having both holes being placed inward or next the cylinder, and the left hand hole meeting that through the bottom being directly over one through the top of the boiler. Place the faced side of the cylinder against the fixed plate, the projecting pin of which enters the hole in the cylinder plate and the pointed screw through the pillar engaging with the opposite hole in the side of the cylinder. The pillar is soldered in this position to the top of the boiler, and the other is similarly secured at the distance of about one inch. The cylinder bottom is a thin plate of brass soldered on. When the crank and piston are at their lowest points, the latter should not quite reach the lower hole in the cylinder. The wheel may be of iron, about $4\frac{1}{2}$ inches diameter, to be obtained at any iron foundery, or be cast of lead, or lead and tin. The gage cock may be attached $3\frac{1}{4}$ inches from the bottom, and if filled to this hight the boiler will furnish steam for half an hour's safe running. The boiler may be filled by the safety valve. To start the engine set the boiler on a stove or range, or place it over a lamp. The first is the preferable mode as being more cleanly.

An engine of this fashion need not cost much, and its construction would afford useful employment to boys in town or country, and be a source of pleasant and profitable amusement during winter evenings.

Correspondence.

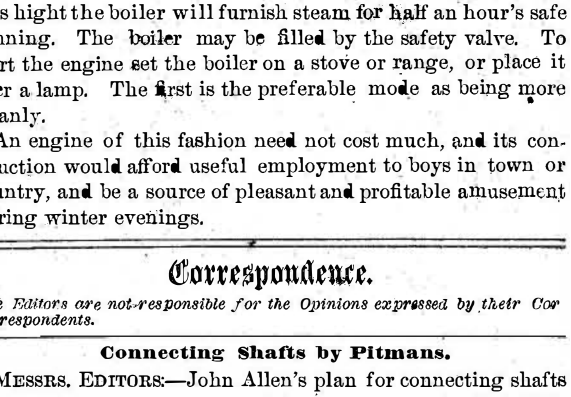
The Editors are not responsible for the Opinions expressed by their Correspondents.

Connecting Shafts by Pitmans.

MESSRS. EDITORS:—John Allen's plan for connecting shafts by pitmans, a diagram of which is given on page 20, Vol. XIX, and which "Aberdeen," on page 69, same volume, says won't work, will not work. With a trifling alteration it will work finely.

D. H. McCormick's diagram, on page 21, Vol. XX, will not work unless there is something on the shaft not shown in his diagram to throw it over the dead center. Will Mr. McCormick please explain his diagram.

I append a diagram showing a modification of John Allen's device that will work. A is the main or driving crank; B is the fulcrum which is made permanent in the center of the connecting bar and slides in its bearing, B, slotted for the purpose. The crank, D, is slotted at the end to allow the crank-pin to slide to and from the center. The crank pin will describe a curve shown by the dotted line E. In this way the movement will be perfectly free and smooth, though with slightly varying velocity in the revolution of the crank D.



C. H. PALMER.

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Periodic Oscillations of the Earth.

MESSRS. EDITORS:—An article in your paper indicates a theory of earthquakes and volcanoes originating from gaseous explosions as opposed to the general belief in a molten sea beneath the earth's crust, and basing the improbability of such